What is the role of phonology in sentence comprehension during silent reading?

Although many studies have shown that phonological repetition causes reading comprehension difficulties ([1], [2], [3], [4]), the nature of these processing costs remains unclear.

Purpose of the study:
To shed light on this issue by examining
(i) the time-course of form interference effects,
(ii) the interaction of these effects with syntactic processing difficulty,
(iii) the extent to which these effects relate to phonological or orthographic overlap.

Sentence Types
(1a) unreduced/reduced RC; O+P:
The infection (that was) left by the injection badly hurt the young child.
(1b) unreduced/reduced RC; control:
The infection (that was) left by the medicines badly hurt the young child.
(2a) unreduced/reduced RC; O+P:
The laughter (that was) caused by the daughter continued on throughout the party.
(2b) unreduced/reduced RC; control:
The laughter (that was) caused by the minister continued on throughout the party.

Methodology

Experiment 1: Unreduced and reduced RCs with orthographically and phonologically related (O+P) words (1a) or length/freq. matched controls (1b)
Length: 5-9 letters, M=5.67
Freq.: O+P  22.35  Control  19.70

Experiment 2: Unreduced and reduced RCs with orthographically related but phonologically unrelated (O+P-) words (2a) or length/freq. matched controls (2b)
Length: 5-8 letters, M=5.67
Freq.: O+P-  33.57  Control  23.38

Materials: 48 sets of sentences, 60 fillers.

Task: Eye-tracking during single-sentence reading
• Y/N comprehension questions after each item

Participants: 64 UTA students, English NS
• 32 for Experiment 1, 32 for Experiment 2

Results (cont.)
Interaction of form interference and syntactic difficulty?
• only in EX1
• only in late measures

Discussion
• Robust syntactic processing effects in both experiment at the disambiguating by-phrase in reduced RC sentences (consistent with previous research [5]).
• Processing difficulty under first-pass and total RT measures in both experiments at the form-related word, i.e., at the O+P word in EX1 at the O+P- word in EX2.
• No interaction of form interference effects with syntactic processing effects in first-pass RT measures.

Conclusion:
• Form similarity causes interference even in the early stages of silent reading.
• This interference occurs independently of syntactic processing difficulty.
• Cannot be attributed exclusively to phonological form overlap (i.e., costs for both O+P- and O+P- words).
• The late interaction of form overlap and syntactic processing effects only for O+P sentences suggests that phonological info might play a more important role than orthographic info in comprehension processes related to the retention of sentence representations in working memory.

References

Form Interference Effects During Silent Reading
Iya Khelm, Naoko Witzel, & Jeffrey Witzel
University of Texas at Arlington

Experiment 1 (O+P+)
First-pass RT
sum of fixation durations after entering a region until leaving in any direction

Go-past RT
sum of fixation durations after entering a region until leaving in the right (includes regressive fixation on previous regions)

First-pass regression proportion
proportion of trials on which there is a regressive eye movement to a previous region on the total pass through the sentence.

Experiment 2 (O+P-)
First-pass RT
Go-past RT

First-pass regression proportion

Discussion
• Robust syntactic processing effects in both experiments at the disambiguating by-phrase in reduced RC sentences (consistent with previous research [5]).
• Processing difficulty under first-pass and total RT measures in both experiments at the form-related word, i.e., at the O+P word in EX1 at the O+P- word in EX2.
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Results

Experiment 1 (O+P+)

Experiment 2 (O+P-)

Methodology

Experiment 1: Unreduced and reduced RCs with orthographically and phonologically related (O+P+) words (1a) or length/freq. matched controls (1b)
Length: 5-9 letters, M=5.67
Freq.: O+P+  22.35  Control  19.70

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